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Global and Regional IUCN Red List Assessments: 11

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Abstract

In this contribution, the conservation status assessment of three vascular plants according to IUCN categories and criteria is presented. It includes the global assessment of *Limonium parvifolium* Tineo and *Viscaria alpina* (L.) G.Don, and the regional assessment of *Rhazya stricta* Decne. (Iraq).

Keywords

conservation, extinction risk, IUCN protocol, threats

How to contribute

The text of the global and regional assessments should be submitted electronically to Simone Orsenigo (simone.orsenigo@unipv.it) or to Giuseppe Fenu (gfenu@unica.it); the text, up to 8000 characters in length (spaces included), must include a distribution map and a picture of the assessed species.

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Red List Assessments

Limonium parvifolium (Tineo) Pignatti

Global assessment
Taxonomy and nomenclature
Order: Caryophyllales *Family*: Plumbaginaceae

Limonium parvifolium (Tineo) Pignatti, Bot. J. Linn. Soc. 64(4): 364 (1971) ≡ *Statice parvifolia* Tineo, Fl. Sic. Syn. 2: 806 (1845) ≡ *Statice gracilis* Tineo, Fl. Sic. Syn. 2: 807 (1845) ≡ *Statice pygmaea* Tineo, Fl. Sic. Syn. 2: 807 (1845).

Common name: Limonio gracile, Limonio parvifloro (It).

Geographic distribution range: *Limonium parvifolium* (Fig. 1) is a narrow endemic of the island of Pantelleria (Sicily) and its distribution consists of a single population in a volcanic area called Gelfiser (Fig. 2). This species was described by Gussone (1845) as *Statice parvifolia*, on specimens sent to him by V. Tineo who collected it in Pantelleria. Later, Pignatti (1971) proposed a new combination of *L. parvifolium* based on *S. parvifolia*, which is currently the most correct and has priority compared to the other binomials (Brullo et al. 2020).

Distribution: *Countries of occurrence:* Italy (Sicily).

Biology: *Plant growth form:* perennial (suffruticose chamaephyte).

Flowering and fruiting time: Flowering from May to August and fruiting from August to September.

Reproduction: There is no detailed information on the pollination system and seed dispersal mechanism.

Habitat and ecology: *Limonium parvifolium* grows on volcanic rocky slopes of Pantelleria only in a locality known as Gelfiser. In particular, the species colonizes a tall and shaded vertical cliff characterized by rich lichen and mosses communities, where only a few other vascular plant species occur. The altitude range falls between 250 and 300 m a.s.l., within the lower thermomediteranean bioclimatic belt with lower dry ombrotype (Bazan et al. 2015). From a vegetational point of view, it is linked to a chomophytic moss-rich community dominated by *Polypodium vulgare* L. and referable to *Polypodietea vulgaris* Jurko & Peciar ex Boscaiu et al. 1966 class.

Population information: the species shows a very narrow distribution, with only one circumscribed stand on the island. Recent field surveys revealed that the population includes a few mature individuals (about 15); the trend for this population has shown a significant decline in the last 10 years.

Threats: *10.3 Avalanches/landslides*: this species grows on a volcanic rocky cliff subjected to natural erosion and, therefore, landslides.

11.1 Habitat shifting and alteration: fieldwork showed that the growth habitat could be threatened by climate change. Indeed, changes in pluviometric regimes could

Figure 1. *Limonium parvifolium* (Tineo) Pignatti on the volcanic rock cliff at Gelfiser (Pantelleria, Sicily). Photograph by S. Cambria.

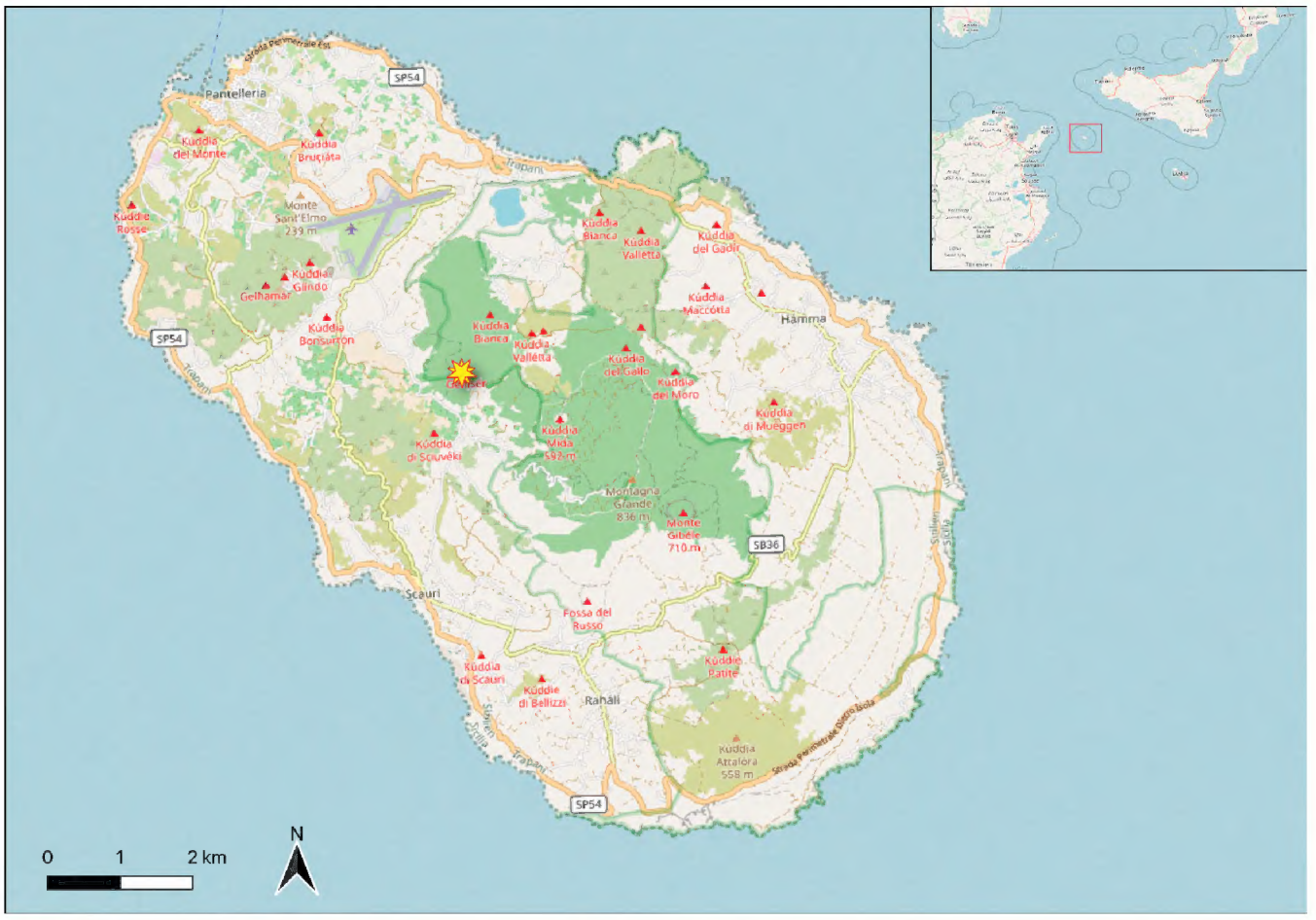

Figure 2. Geographic range and distribution map of *Limonium parvifolium* (Tineo) Pignatti in Pantelleria (Sicily).

negatively impact on this species that is restricted to a particular microclimate characterized by humid and shady conditions.

11.2 Drought: the survival of *L. parvifolium* is linked to humid cliffs; extreme drought (linked to rainfall deficit) could cause the rapid disappearance of the species.

CRITERIA APPLIED

Criterion B: **AOO**: 4 Km^2 calculated with GeoCAT (Geospatial Conservation Assessment Tool) programme (Bachman et al. 2011).

a) Number of locations: the only known population is localized in a very restricted area. The most important threat is represented by climate change.
b) Several field observations revealed that habitat quality (iii) as well as the number of mature individuals (v) are declining.

Criterion D: Number of mature individuals < 50

Red List category and Criteria (Global Assessment)

CR	**Critically Endangered**	**B2ab(iii,v)+D**

Rationale for the assessment: *Limonium parvifolium* is an endemic species restricted to a small area on the island of Pantelleria where a recent survey revealed that it is represented by less than 50 mature individuals. In particular, it occurs on a vertical cliff, and various threats are expected to impact the species in the near future. The AOO is less than 10 km^2 so that, according to criteria B and D, this species can be assessed as Critically Endangered (CR).

Previous assessment: In the past, the species was reported as LR (Lower Risk) by Conti et al. (1997). More recently, it was evaluated as Least Concern (LC) at a global level (Orsenigo et. al. 2018). However, this evaluation was probably based on an overestimation of the number of individuals. In fact, some authors included the species within *L. cosyrense* (Guss.) Kuntze (Giardina et al. 2007), reporting its occurrence in locations with climatic and edaphic conditions different from those required by *L. parvifolium*, which is typically non-halophilic. These hypotheses are supported by recent field investigations (Brullo et al. 2020).

Conservation actions: Pantelleria is a National Park since 2016 because it represents an area of great naturalistic value. Despite this, *L. parvifolium* is not included in any conservation or monitoring activities. Moreover, the population falls within the SAC ITA010019 "Isola di Pantelleria: Montagna Grande e Monte Gibele".

Conservation actions needed: Research and monitoring programmes are recommended in order to better understand the reproductive biology and population trends of the species. In addition, *in situ* and *ex* situ conservation measures are suggested for potential plant translocation programmes, with the goal to increase the low number of individuals in the population.

Salvatore Cambria, Gianmarco Tavilla, Dario Azzaro

Rhazya stricta Decne.

Regional assessment (Iraq)
Taxonomy and nomenclature
Order: Gentianales *Family:* Apocynaceae

Rhazya stricta Decne. Ann. Sc. Nat. Ser. 2, 4: 80 (1835).

Common name: Sihar, Hisawarg, Orgalama (Pakistan, India), Senhwar, Sahaer, Dogbane, Harmal, Luwaiza, Harmal (Arabic; in Iraq the name Harmal is more commonly used for *Peganum harmala*).

Geographic distribution range: *Rhazya stricta* (Fig. 3) is an evergreen woody shrub, mostly found in the Middle East and South Asia, whose actual current distribution is still uncertain in some countries. In Iraq there are only two populations, distributed in the desert of Al-Najaf province: the two sites, Al-Buwair (31.495218°N, 44.209923°E) and Birkat Al-Talhat (30.925388°N, 43.898037°E), are about 60 km apart (Fig. 4). There are sporadic isolated groups of few individuals (2–6) distributed north of the Al-Buwair site.

Distribution: Afghanistan, Bahrain, Kuwait, India, Iran, Iraq, Oman, Pakistan, Qatar, Saudi Arabia, United Arab Emirates, and Yemen (Kew Science 2021).

Biology: Perennial (chamaephyte).

Flowering and fruiting time: Flowering from December to May.

Reproduction: Reproduction occurs by seeds. No detailed information is available on the pollination system and seed dispersal mechanism.

Habitat and ecology: *Rhazya stricta* is a perennial evergreen woody shrub, up to 80 cm high, well adapted to harsh desert conditions with its strong foliage, tap roots and high salt tolerance. It grows on sandy or silty soil and represents one of the structural species of the desert vegetation on sand dunes and on gravelly or stony substrates (Ghazanfar and Osborne 2010). *Rhazya stricta* is a sand-fixing shrub for sand stabilization in the Al-Najaf desert, allowing various plant species to grow nearby and also offering shelter for wild animals. The area has hot summers and cool winters. Although precipitation is scarce (100–150 mm/year), the region receives transitory violent rainstorms in winter (Al-Rammahi and Mohammad 2020).

Population information: There is no detailed information available on population dynamics; however, an overall monitoring carried out in 2019–2021 shows that the Iraqi population consists of 13,296 mature plants, 7,989 of which in Al-Buwair and 5,307 at Birkat Al-Talhat.

Threats: *2.1 Annual & perennial non-timber crops*: since there are some fields cultivated intermittently with wheat or barley (rainfed irrigation), preparing the area for cultivation could have a negative impact on the shrubs found in the area.

3.2 Mining & quarrying: sand and gravel quarries, that provide construction works with raw material, are present in the sites where the population grows.

4.1 Roads & railroads: the increasing presence of 4WD off-road vehicles driving across the area is reducing the surface and quality of the population's habitat.

Figure 3. *Rhazya stricta* at Birkat Al-Talhat, Al-Najaf desert, Iraq. Photograph by Mohmmad K. Mohammad.

Figure 4. Geographic range and distribution map of *Rhazya stricta* in Iraq.

5.3 Logging & wood harvesting: the plant is used by locals in traditional medicine resulting in unregulated and continuous damage to individuals. Since almost all parts of the plant are used for this purpose (leaves, stems, roots, and seeds), individual survival and recruitment are strongly compromised.

6.2 War, civil unrest & military exercises: the continuous presence of military activities (transit of military vehicles, setting up of military camps) in the areas occupied by both populations impact negatively on this species.

9 Pollution (*9.2 Industrial & military effluents* and *9.3.2 Soil erosion, sedimentation*): The presence of a cement plant, along with pervasive agricultural practices, are promoting an overall loss of soil quality in the species' habitat.

11 Climate change & severe weather (*Droughts, Temperature extremes, and Storms & flooding*)*:* the rate of precipitation in Al-Najaf desert is very low (*ca.* 90 mm/year) leading to a severe shortage in water. Nonetheless, recurrent floods due to rainstorms result in uprooting of some individuals, especially juvenile ones. In addition, the annual average minimum temperature is increasing faster than maximum temperature, and the overall temperature in Iraq increases much faster than the global average (Salman et al. 2017). During summer, temperatures reach 50–54 °C in southern parts of Iraq (Ahmed and Hassan 2018).

CRITERIA APPLIED:

Criterion B: **EOO:** 629.8 km^2 calculated with GeoCAT (Geospatial Conservation Assessment Tool) software (Bachman et al. 2011).

AOO: 84 km^2 calculated with GeoCAT software (Bachman et al. 2011).

a) Number of locations: we identified two locations based on the main threat (2.1 Annual & perennial non-timber crops).

b) Due to the severe threats observed, habitat quality (iii) is declining in all sites as well as the number of mature individuals (v).

Red List category and Criteria (Regional Assessment)

EN	**Endangered**	**B1ab(iii,v)+2ab(iii,v)**

Rationale for the assessment: *Rhazya stricta* has a restricted distribution in Iraq, where it is located in the desert of Al-Najaf province, with only two populations about 60 km away from each other and affected by several threats. The EOO is less than 5,000 km^2, the AOO is less than 500 km^2, and according the main threat we can identify 2 locations as well as a continuous decline in habitat quality and number of mature plants. According to criterion B, this taxon can be assessed as Endangered (EN) at regional level. Because geographical isolation makes any contribution by populations occurring in neighbouring countries to the conservation status of the Iraqi ones unlikely, there is no reason for up- or down-grading the risk category resulting from this assessment procedure.

Previous assessment: Taxon not evaluated (NE) at the global level (IUCN 2021).

Conservation actions: At present, there are no conservation measures for this species in Iraq.

Conservation actions needed: The suggestion of Fenu et al. (2020) to declare a national protected area at the Talh for the occurrence of *Vachellia gerrardii* (Benth.) P.J.H.Hurter subsp. *negevensis* (Zohary) Ragup., Seigler, Ebinger & Maslin could be applied here also for *Rhazya stricta*. In fact, the distribution areas of both plants partially overlap. According to current legislation, this action could prevent the local authorities from renting lands where the two species are growing for agricultural or sand-gravel quarry purposes. Also, this will ensure a sustainable use of the plant for traditional medicine needs.

Note: *Rhazya stricta* leaves and branches are used in traditional medicine for the treatment of many diseases (Mariee et al. 1988). It is a poisonous plant for domestic animals (Mandaville 2011).

Mohammad K. Mohammad, Hayder M. Al-Rammahi, Giuseppe Fenu

Viscaria alpina (L.) G. Don

Global assessment
Taxonomy and nomenclature
Order: Caryophyllales *Family*: Caryophyllaceae

Viscaria alpina (L.) G.Don, Gen. Hist. 1: 415. 1831 ≡ *Lychnis alpina* L., Sp. Pl.: 436. 1753 ≡ *Agrostemma alpina* (L.) J.Forbes, Hort. Woburn.: 104. 1833 ≡ *Liponeurum alpinum* (L.) Schott, Nyman & Kotschy, Analect. Bot.: 55. 1854 ≡ *Silene liponeura* Neumayer, Vehm. Zool.-Bot. Ges. Vienna 72: 55. 1923 ≡ *Steris alpina* (L.) Šourková, Novit. Bot. Inst. Horto Bot. Univ. Carol.: 27. 1976 = *Lychnis frigida* Schrank, Denkschr. K. Baier. Bot. Ges. Regensburg 1 (2): 25. 1818 = *Lychnis suecica* Lodd., Bot. Taxi. 9: t. 881. 1824 ≡ *Viscaria suecica* (Lodd.) Sweet, Hort. Brit., Ed 3: 66. 1839 ≡ *Silene suecica* (Lodd.) Greuter & Burdet in Willdenowia 12: 190. 1982 = *Lychnis helvetica* G.Don ex Loudon, Hort. Brit.: 186. 1830 ≡ *Lychnis alpina* var. *americana* Fernald, Rhodora 42: 259. 1940 ≡ *Viscaria alpina* subsp. *americana* (Fernald) Böcher, Biol. Skr. 11: 27. 1963 ≡ *Lychnis alpina* subsp. *americana* (Fernald) Feilberg, Meddel. Gronland, Biosci. 15: 12. 1984 ≡ *Steris americana* (Fernald) Ikonn., Novosti Sist. Vyssh. Rast. 24: 81. 1987 = *Viscaria alpina* var. *serpentinicola* Rune, Acta Phytogeogr. Suec. 31: 56. 1953 ≡ *Lychnis alpina* var. *serpentinicola* (Rune) Kallio & Y.Mäkinen, Ann. Univ. Turku, A, Biol. Geogr. Geol. 67: 63. 1982 = *Viscaria alpina* subsp. *borealis* Böcher, Biol. Skr. 11: 27. 1963 ≡ *Steris alpina* subsp. *borealis* (Böcher) Á.Löve, Phytologia 50: 171. 1982 ≡ *Steris borealis* (Böcher) Ikonn., Novosti Sist. Vyssh. Rast. 24: 82. 1987.

Common name: Crotonella alpina (It), alpine catchfly (En), duottarbihkkarássi (Fin), fjellnellik (Nor), fjällnejlika (Swe), silène de Suède (Fr)

Geographic distribution range: *Viscaria alpina* (Fig. 5) is an amphi-atlantic arctic-alpine plant (Hultén 1958; Hegi et al. 1906), found in Scandinavia (Norway, Sweden,

Figure 5. *Viscaria alpina* at Mount Prado, Northern Apennines, Italy. Photograph by Thomas Abeli.

Finland), parts of north-western Russia, Scotland (UK), north-eastern North America (Canada), Greenland, and Iceland. Some isolated populations occur in the western and central Alps (France, Switzerland, Italy, Austria), northern Apennines (Mount Ragola and Mount Prado, Italy), Sierra Cantabrica, Sierra de Gredos, Pyrenees (Spain and France). This species has a continuous range in northern Europe, while in the south of Europe it has a fragmented distribution (Fig. 6).

Distribution: *Countries of occurrence*: Austria, Canada, Finland, France, Great Britain, Greenland, Iceland, Italy, Norway, Russia, Spain, Sweden, and Switzerland.

Biology: *Plant growth form*: perennial (hemicryptophyte rosette).

Chromosome number: $2n = 24$ (Nagy 2013).

Flowering time: From June to August.

Reproduction: Entomophilous pollination. At maturity, in the autumn, capsule open and seeds are passively dispersed (Nagy 2013). Germination and seed dormancy vary among populations. Germination occurs under warm temperatures (20/15 °C) and it is promoted by cold stratification. Subarctic populations of *V. alpina* are less dormant, showing a warmer suitable temperature range for germination, and a higher germinability than alpine populations (Mondoni et al. 2018).

Habitat and Ecology: *Viscaria alpina* grows especially in siliceous rocky cliffs and alpine grasslands between 2,000 and 2,850 m a.s.l. (Abeli et al. 2012). This species can be found in rocky outcrops and fell-field with neutral, slightly acidic soil, or ultramafic soil (high magnesium and nickel concentrations) in Britain and Scandinavia;

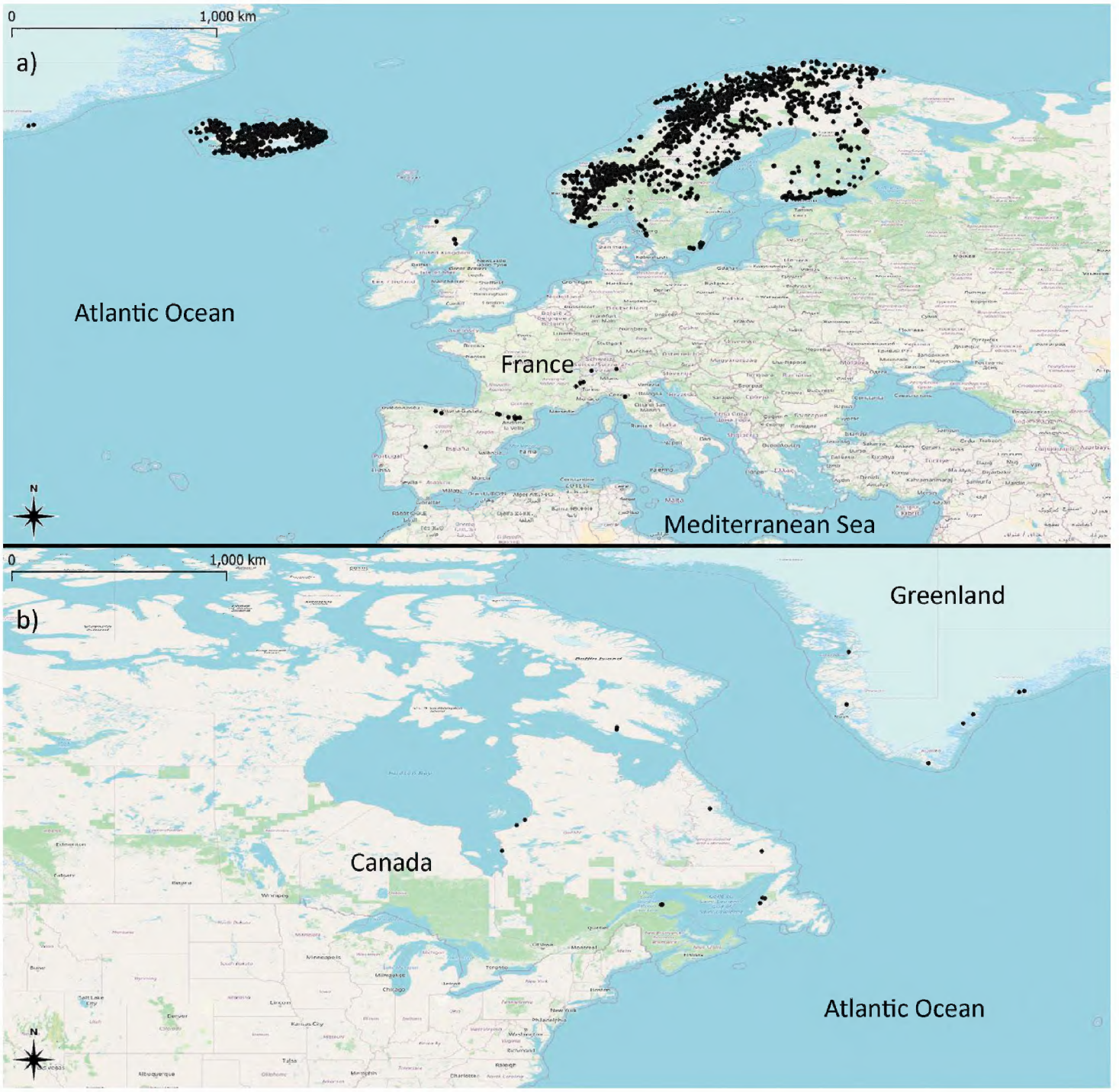

Figure 6. Global geographic range and distribution map of *Viscaria alpina*: a) Europe and b) North America and Greenland.

in mesic to dry alpine habitats (in the southern European mountain ranges); in open areas in the boreal/montane forest zone in Scandinavia and in the lowland alvar in Öland, Sweden. For *V. alpina* there are five climatic types related to its geographical distribution: oceanic-montane-low arctic (coastal Greenland, alpine zone of the Scandinavian mountains, and alpine mountains of southern and central European), continental low arctic (interior western Greenland), temperate subcontinental (Öland), subarctic-subcontinental (Scandinavian montane forest zone), and a subarctic-oceanic type (Iceland) (Nagy 2013).

Population information: There is no detailed information available on population dynamics. Abeli et al. (2012) showed that the reproductive performance of *V. alpina* at the southern range edge fluctuates greatly among years and it is affected by extreme weather events. In particular, heat waves can strongly reduce the species' reproductive performance in terms of flowers and fruits produced. The population of Mt. Prado

(northern Apennines, Italy) is being monitored for more than 20 years and it is highly stable in terms of flowering rosettes (T.A., personal observation).

Threats: *2.3.1 Livestock Farming & Ranching* (*nomadic grazing*)*:* some populations in southern Europe are threatened by livestock (sheep, goats) trampling and grazing. Soil nutrient enrichment due to droppings deposition is a further indirect threat caused by livestock.

6.1 Recreational activities: Human trampling during the tourist season. Some populations grow near hiking paths highly frequented by hikers during the flowering season, specifically the southernmost population in the northern Apennines (Italy).

11.2 Droughts & 11.3 Temperature extremes: Studies suggest that extreme temperatures recorded during summer heatwaves can reduce the reproductive performance of the species (Abeli et al. 2012). Most populations occur in remote areas especially in the northern part of the range, so the impact of the abovementioned threats is null or low.

CRITERIA APPLIED:
Criterion B: **EOO:** > 20,000 km^2
AOO: > 2,000 km^2

Number of locations > 10
No decline observed
No extreme fluctuations observed

Red List category and Criteria (Global Assessment)

LC	Least Concern

Rationale for the assessment: The species has a wide distribution with no observed decline. None of the criteria are applicable.

Previous assessment: This taxon is not evaluated (NE) at the global level (IUCN 2021). At a regional level, *Viscaria alpina* was assessed as NT in the UK (Cheffings and Farrell 2005), Finland (Hyvärinen et al. 2019), and Switzerland (Moser et al. 2002).

Conservation actions: Several populations are within protected areas like national parks and Natura 2000 sites. There are 35 seed accessions stored in the seed banks of the European Native Seed Conservation Network (http://ensconet.maich.gr/About.htm). These accessions are from Norway, Spain, UK, Italy, and Sweden. According to the Botanic Garden Conservation International database PlantSearch, there are 71 living collections of the species in botanic gardens worldwide (BGCI PlantSearch 2021; https://tools.bgci.org/plant_search.php). The population of Mt. Prado is being monitored since 20 years.

Conservation actions needed: To increase the genetic diversity of the *ex situ* collections more accessions from other populations and countries should be obtained. Monitoring programmes for populations at the range edges, the most vulnerable to climate change, should be established.

Martina D'Agostino, Thomas Abeli

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